GUIDELINES FOR HERBACEOUS STAND EVALUATION

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After a herbaceous (grasses & legumes) planting has been made the question occasionally arises whether the stand is adequate. The purpose of agronomy technical note IL-2 is to provide some guidelines and tools that may be helpful in determining stand adequacy.

In determining stand adequacy there are two major considerations: 1) adequate protection of the soil resource, and 2) adequate stand for the planned purpose.

Protection of the soil resource is determined by the percentage of the soil surface that is protected by the vegetative cover.

The wind erosion and water erosion equations are used to determine the degree of protection or amount of soil loss that might be expected. One of the objectives of any herbaceous planting should be to obtain an adequate stand as soon as possible to keep soil loss to a minimum especially during the establishment period.

The second consideration is whether the stand is adequate for the planned purpose. Herbaceous plantings are made for a variety of reasons. The most common reasons are for the production of forage crops, wildlife habitat, or for protection of the soil resource. There are, of course, situations where both are needed or desired. Because of economic considerations, early establishment and density of a stand of desirable species is usually more important for a production planting than for a planting made on idle land only for protection. Rapid establishment on a critical area planting is also important because of the erosive nature of the site.

How rapidly a seeding develops and the density of the stand is dependent on several factors. Some of these factors include: weather (temperature and moisture) after seeding, seedbed conditions, planting depth, seed soil contact, seeding rate, seed quality (germination and % purity), insects and diseases. Also, the amount of time after the seeding was made and when the seeding is evaluated will make a difference as to the density of the stand.

Pure stands of grasses and legumes naturally reach a climax density when mature. The density will depend on the management applied to the stand. Stands of most grasses that are mowed 3 to 5 times a year will generally have a higher plant density than a stand that is never mowed or mowed only once a year. Legume stands mowed 2 or 3 times per year are likely to have a higher plant density than when mowed less or more frequently than 2 or 3 times.

Assuming an adequate job of seeding and cooperation of the weather, a much higher density of plants would be expected four to six months after seeding than one year after seeding. Likewise, expect fewer plants two years after seeding than one year. As an example, in Table 1,

an adequate stand of alfalfa for production purposes would be 6 plants per square foot. Generally, this would be considered an adequate density for most alfalfa seedings two years old under good management and capable of producing high yields. Maximum yields may require 12 to 18 plants per square foot at 2 years of age.

Assuming the seeding rate was 12 pounds per acre and 200,000 seeds per pound of alfalfa, (Table 2) 2,400,000 seeds would be planted per acre or 55 seeds per square foot (2,400,000/43,560 sq. ft./ac.). If the germination (plus hard seed) of the seed lot was 90% then there would be 50 pure live seeds (55 X .90) planted per square foot. Theoretically then, under ideal conditions we could expect to find 50 plants per square foot when all the seeds have germinated and the plants have emerged. In real life we know it doesn't happen this way because all the factors involved in getting a stand are rarely at 100 percent. Poor seedbed condition, lack of moisture, hot temperatures, too deep of planting, insects, disease and other factors take their toll either on the seed or the seedling. Even after a good dense stand is established, the density will continue to decrease through "survival of the fittest" from competition for space, moisture, sunlight, from weeds and attack by insects and diseases. Most grass-legume stands reach their climax density two years after seeding and will maintain the same density indefinitely if properly managed and not affected by severe weather conditions or attack by insects or diseases.

A method of determining stand emergence and establishment is needed at times to help make a decision whether a stand is adequate or needs to be reseeded and for documentation and reference purposes. Determining stand density can be done in an accurate manner and in a short period of time by using a frame count technique. Correct plant identification is necessary to ensure accuracy. Knowledge of the vegetative characteristics of the species to be sampled is essential. If the field is sampled soon after emergence, a plant can often be uprooted with the seed attached to aid in identification.

A one square foot frame is easily constructed with a variety of materials and shapes. A circular frame will present the least edge to area ratio. Error due to sampling increases as the ratio of edge to area increases, and the smaller the sampling unit, the greater the edge error. A circular one square foot frame will have a circumference of approximately 42.5 inches. One can be constructed from 3/16 inch plastic covered cable. The ends can be joined with a short section (1 inch) of .25 outside diameter cooper tubing.

The number of samples required depends on factors such as stand uniformity and the number of species to be counted. Generally a minimum of 10 counts or samples per 10 acres or less of field size would result in a representative sample. An effort must be made to avoid end rows or turn around areas that may have been double seeded. The observer must not be biased by dense or sparse stands, but needs to sample equally in a systematic manner.

To begin a sampling transect, select a landmark on the horizon to walk towards in a straight line. The sampling pattern should be such that a representative plant density is obtained. A pre-determined number of steps should be taken on a line that is diagonal or perpendicular to the drill rows or the direction the seeding was done. When the number or pre-determined steps have been taken, drop the frame at the toe of your shoe on the final step. Only those plants that are rooted within the frame will be counted and used in determining the stand density.

The above procedure is not time consuming, and ten counts can be made in a matter of fifteen to thirty minutes, depending on the number of species to be counted. If the stand is spotty and

includes skip areas, then more samples than the minimum may be required. If a portion of the field has had a different cropping history, fertilization program or major differences in soil types or slopes, the sampling should be stratified and the average plant densities kept separate for the different areas. Tabular entries should be made after each frame count to ensure accuracy. Initial stand counts should be made before excessive plant growth makes frame alignment and the counting procedure more difficult. The time the sampling is done could be based on the purpose of the seeding. If the above technique or method is used to evaluate a planting technique or for forage production, the first evaluation should be 4-6 weeks after germination. Follow-up evaluations could be at any other pre-determined interval. For seedings made for protection of idled land or critical areas, 4-6 months after seeding may be sufficient.

Table 1 provides some guidelines to help determine if a stand is adequate, questionable, or inadequate, based on species planted and the planned use. Using a frame size of one square foot, the number of seedlings counted per frame or the average of the samples taken on an area and compared to the values in Table 1 will indicate if a stand is adequate, or inadequate according to the numbers. If the count falls between adequate and inadequate then the stand is questionable. Questionable stands will need to be re-evaluated at a later time.

Weeds may also be inventoried during the sampling process; however, they should not be used to determine the adequacy of the stand.

Where introduced, or cool season species are seeded, an evaluation after one full growing season or one year after seeding should give a good indication of what the final stand will be. If it is still inadequate then reseeding should be recommended. For native (warm season) species determined to be questionable or inadequate, because they are usually slower becoming established, final evaluation should not be done until after the second growing season.

If the stand is a mixture of species, all values in Table 1 should be reduced by the ratio of each species planned percentage in the mixture. For example, if the planned seeding is to result in a mixture of 50% orchardgrass and 50% alfalfa then the values in table 1 would be reduced by 50% for both components of the mixture. The percentage of a species in a mixture is based on the number or percentage of pure live seeds of each species to the total pure live seeds planted.

A sample form is included for your information and use. The information obtained from sampling plant density can be used as a reference point when assisting a landuser making management decisions or evaluating seedings for program purposes. In some cases it may be determined that spot seeding is necessary because of a non-uniform stand. The sketch diagram indicating how the field is sampled should help define the areas needing reseeding. As the field is being sampled, the observer has the opportunity to spot weed infestations which may need to be controlled before they cause seedling mortality. The stand evaluation worksheet should be used as a management tool as well as a means of documenting stand establishment.

IF STANDS ARE OBVIOUSLY ADEQUATE OR INADEQUATE BY VISUAL OBSERVATION A FORMAL STAND EVALUATION IS NOT NECESSARY. However, if the stand is questionable by visual observation or documentation is required, the above procedures will be used to substantiate the actual condition.

STAND EVALUATION

Conservationist_____ Landowner_____
Date_____ Program_____
Practice Name_____ Code_____

Plant Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total	Avg.
TOTAL PER COUNT*																											

Planting Date_____ Soil Type(s)_____
Age of seeding_____yrs_____mo Seeding direction_____
Total acres_____ Density of seeded species_____
Plant vigor_____ Avg. Plant Height_____
Stand is_____Adequate_____Questionable_____Inadequate
Weed Competition_____
_____
_____
Comments_____
_____
_____
_____
Recommendations to Cooperator_____
_____
_____
_____
_____

*(If more than 25 counts ignore bottom totals)

Guidelines

- sample in a systematic and uniform manner
- minimum of 10 counts for each 10 acres or less of field size
- avoid areas that may have been double seeded
- sample perpendicular or diagonal to drill rows - use a 1 square foot frame (12 in. x 12 in.) - use table on reverse side to determine adequacy
- sketch how field was sampled.

TABLE 1 - PLANTS NEEDED PER SQUARE FOOT AT THE END OF SECOND GROWING SEASON FOR HERBACEOUS STAND EVALUATION 1/

	Forage Prod.		Critical Areas		Idle Land	
SPECIES	Adea	Inadea.	Adea	Inadea.	Adea	Inadea.
Big Bluestem	>2.0	<0.5	>3.0	<1.00	>1.0	<0.25
Indiangrass	>2.0	<0.5	>3.0	<1.00	>1.0	<0.25
Switchgrass	>2.0	<0.5	>3.0	<1.00	>1.0	<0.25
Little bluestem	>3.0	<0.75	>3.0	<1.00	>1.0	<0.25
Kentucky bluegrass	>5.0	<2.5	>8.0	<4.0	>4.0	<2.5
Orchardgrass	>5.0	<2.5	>8.0	<2.5	>4.0	<2.0
Redtop	>5.0	<2.5	>8.0	<4.0	>4.0	<1.5
Reed Canarygrass	>4.0	<2.0	>8.0	<4.0	>2.0	<1.0
Smooth bromegrass	>4.0	<2.0	>8.0	<4.0	>4.0	<1.0
Tall Fescue	>5.0	<2.5	>8.0	<4.0	>4.0	<2.0
Timothy	>6.0	<3.0	> 8.0	<4.0	>4.0	<2.0
Alfalfa	>6.0	<3.0	>10.0	<5.0	>4.0	<2.0
Alsike clover	>6.0	<3.0	>10.0	<5.0	>4.0	<2.0
Birdsfoot trefoil	>6.0	<3.0	>10.0	<5.0	>4.0	<2.0
Crownvetch	>4.0	<2.0	>4.0	<2.0	>2.0	<1.0
Ladino clover	>6.0	<2.0	>8.0	<2.0	>4.0	<1.0
Red clover	>6.0	<3.0	>10.0	<5.0	>4.0	<2.0
Sweet clover	>6.0	<3.0	>10.0	<5.0	>4.0	<2.0
Korean Lespedeza	>6.0	<3.0	>10.0	<5.0	>4.0	<2.0
Sericea lespedeza	>6.0	<3.0	>10.0	<5.0	>4.0	<2.0

- > = greater than
- < = less than

1/ For stands less than one year old, multiply values by 2. For stands with one but less than two full growing seasons multiply values by 1.5.

Table 2
Seed Information

LEGUMES	Seeds/Pound	Seeds/SQ. FT. @ 1 LB/ACRE
Alfalfa	200,000	5.0
Alsike clover	700,000	16.0
Birdsfoot trefoil	400,000	9.0
Crownvetch	110,000	2.5
Hairy vetch	20,000	0.3
Ladino clover	800,000	18.0
Red clover	275,000	6.0
Sweet clover	260,000	6.0
Korean lespedeza (unhulled)	225,000	4.5
Sericea lespedeza	350,000	8.0
GRASSES		
Big bluestem (bearded)	165,000	4.0
Creeping red fescue	615,000	14.0
Indian grass (bearded)	175,000	4.0
Kentucky bluegrass	2,177,000	50.0
Little bluestem	260,000	6.0
Orchardgrass	654,000	15.0
Redtop	4,990,000	115.0
Reed canarygrass	533,000	12.0
Smooth bromegrass	136,000	3.0
Switchgrass	389,000	9.0
Tall fescue	227,000	5.0
Timothy	1,230,000	28.0